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THE OLDEST OF THE FORESTS

By DR. JOHN M. CLARKE

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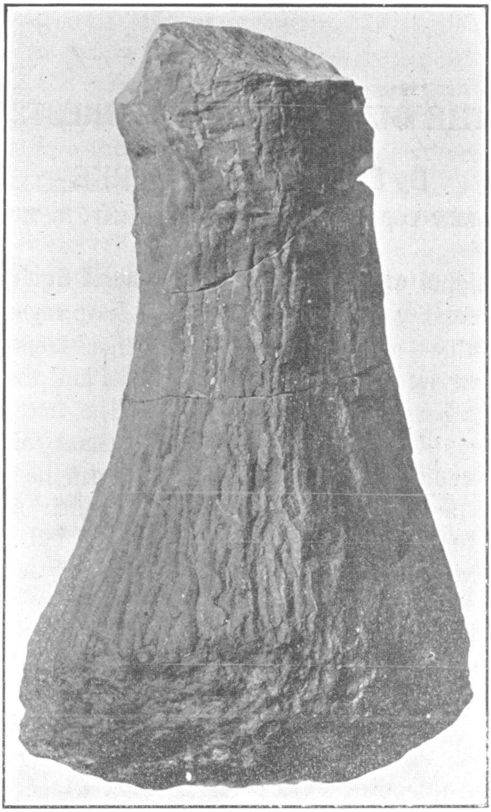
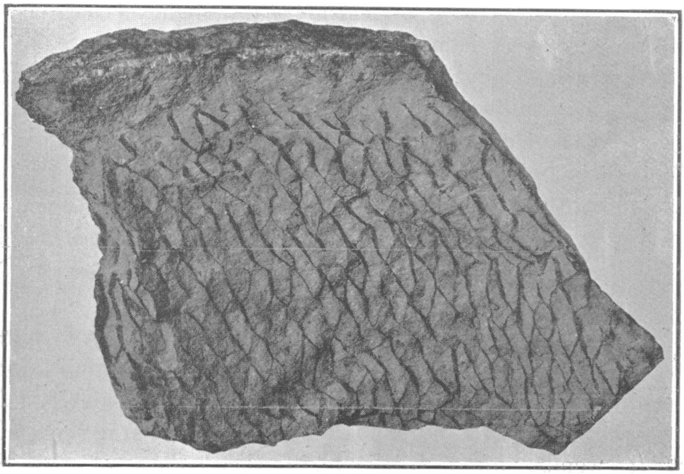
THE chief signal officer of our army, General Squier, has demonstrated the reality of what we might well have regarded an almost fanciful conception—one that might have emerged from the rosy mists when fairies had not been reduced to formulas and the notes of Pan were still to be heard in the forest aisles. The trees of the forest, says this distinguished academician, are antennae of the wireless telegraph and conductors of messages which can be interpreted by human ears if they are in human language. Their other messages, untranslatable to our ears, are left to our fancy, but the trees stand reaching their sensitive finger tips out into the sky and it would be strange indeed if they did not catch and draw down other messages which had to do with their own concerns and upbuilding. The picture is a pretty one and a legitimate fancy indeed if we let the trees in their own silent passages carry on the gossip of the woods, their conversaziones among themselves and the world of life which they shelter.

The fool hath said in his heart that we have passed the age of miracles and that all the phenomena of Nature can be reduced to terms of human understanding. But in the apostolic sense I speak even as a fool in restating so elementary a thought as that the farther we go into the exact interpretation of the facts of Nature, the more deeply the honest mind becomes impressed with the ever enlarging evidence of the miraculous, the processes in Nature which the best of human intellect can not compass or explain. Let the whole organism of the tree be put in terms of chemical and physical reactions, of tissue structure and biological explanation, and the question remains still nakedly unanswered—what is the tree, whence and how has it come, and must remain so until we apprehend the genius and spirit of the tree as well as its substance.

With this short sermon I introduce the brief story I have been asked to tell about the oldest of our forests whose remains are none the less expressive for being turned to stone. The petrified forests of the world have filled museums and homes with fragments of their beautiful woods, often brilliant in the colors of jasper and chalcedony and iridescent with the tints of the opal or their flaming



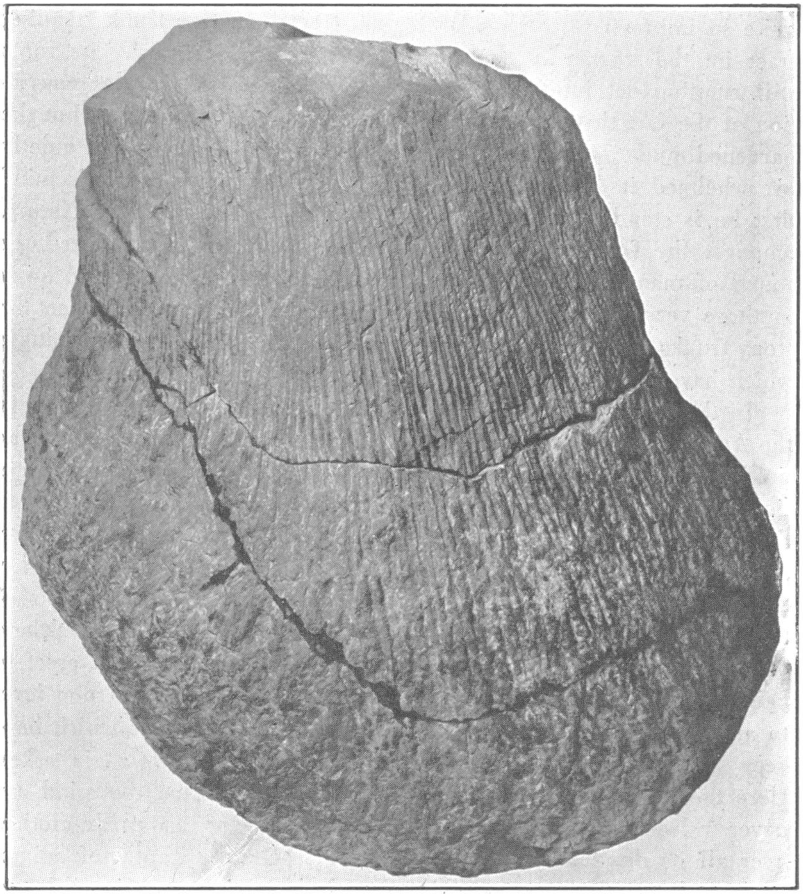
ONE OF THE SMALLER TREES FROM THE UPPER LEVEL



THE OPEN MESH OF VASCULAR BUNDLES INSIDE THE CORTICAL LAYER heart cavities lined with crystals of amethyst, and to a mineralogist all these are only simple evidences of "replacement" by slow process of the woody tissue by silica with various coloring metallic oxides in regions where thermal and alkaline waters abound. It is easy to wave aside such beauties as these with the best explanations we have at hand, but there still remains the greater fact that these objects of our admiration are beautiful and that beauty is not explained by equations. Perhaps among all the worlds of fossil life nothing is quite so impressive to the observer as a petrified tree trunk standing erect in the rocks in the very place where it grew, its roots still running out into the underclays. It conveys a singular conviction of the fact that the embedding rocks about it are after all but the hardened muds in which it grew and which have gradually and quietly overwhelmed it, and there remains no doubt in the observer's mind that he is standing amongst the trees of an earlier order of Nature, amongst the forest groves which in their day must have heard the sound of many voices whose "stilly influences" are still stored away in those very tree trunks. Such an impression is lessened when the stony trunks are in fragments scattered about and prostrated by changes which have befallen since they turned to rock.

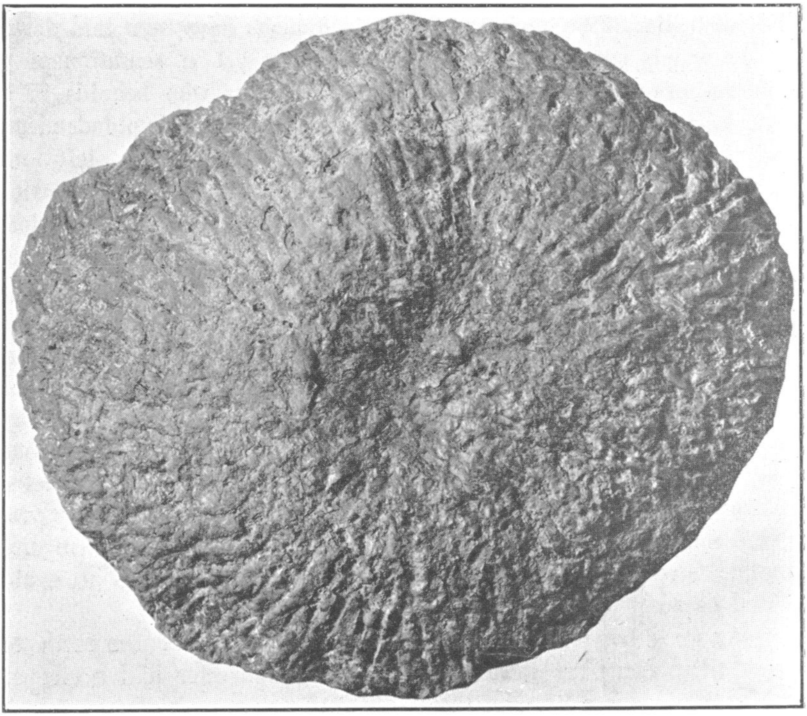
In the midst of the vast and brilliant array of disjected timber in the Arizona forests about Adamana and Holbrook and in spite of the profound impression the mind receives before this unique manifestation of Nature's procedures, the observer has nevertheless the feeling that, as has been often said, he is looking at a great petrified "timber-drive" and a timber-drive is but a raft of chopped down trees. Let the eye catch the marvellous exhibit of the Early Tertiary forests of the Yellowstone National Park, at Junction Butte, at Cache Creek and on the slopes of the Thunderer where the fossil trees stand erect to heights of 20 to 30 feet and the forest bottoms rise from one level to another over not less than fifteen different forest areas which have been buried, each in turn, by the outpourings of volcanic ashes. Here the impression is of so enormous magnitude that the mind can never release itself from the sight enforced; of an earth clothed over all its dry lands with forests giving shelter to hordes of animal life which together were working out the destinies of their evolution untouched and untrammeled by the influence of man.

If such an impression is in any way impaired it may come from the thought that these Yellowstone forests are made up of trees not very unlike those which today help to compose our northern forests. Then, as now, sequoias, other conifers and dicotyledons grew side by side. Even so the much older trees of the Arizona stone timber drives. They are of Triassic age but mostly belong to the race of Araucarian pines, still growing in the mountains of South America

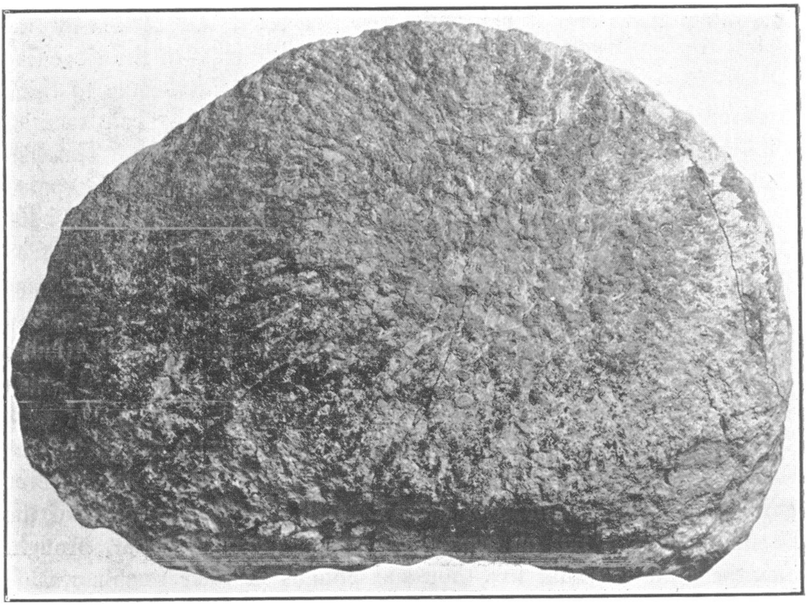


A LARGE STUMP FROM THE UPPER LEVEL. HEIGHT, 38 INCHES and Australia. Fifty thousand feet of sediments have been laid down by the waters since these trees were growing, yet a sensation of a different order comes to the thoughtful observer who beholds in a rock wall of the Coal Period the standing trunks of Lepidodendron and Sigillaria, masters of the coal forests, which have left no descendents among the trees of the living earth. When Sir Charles Lyell in 1842 first saw the petrified Coal forest of the South Joggins, in Nova Scotia, he declared it the most wonderful phenomenon he had ever seen; trees standing perpendicular to the strata to heights of twenty-five to forty feet, piercing the beds of standstone and ending downward with their roots in the coal beds. "This subterranean forest," wrote Lyell, "exceeds in extent and quality of timber, all that have been discovered in Europe put together." The South Joggins coal forest is still on view and a really vast number of trees has been recorded from there. They rise in tier above tier in the rocks, having in their successive lives sunk below the old waters which preceded the Bay of Fundy, while the sand piled up about them and another forest grew at the old level, till all were sunk and all again raised as rocks to where they now stand.

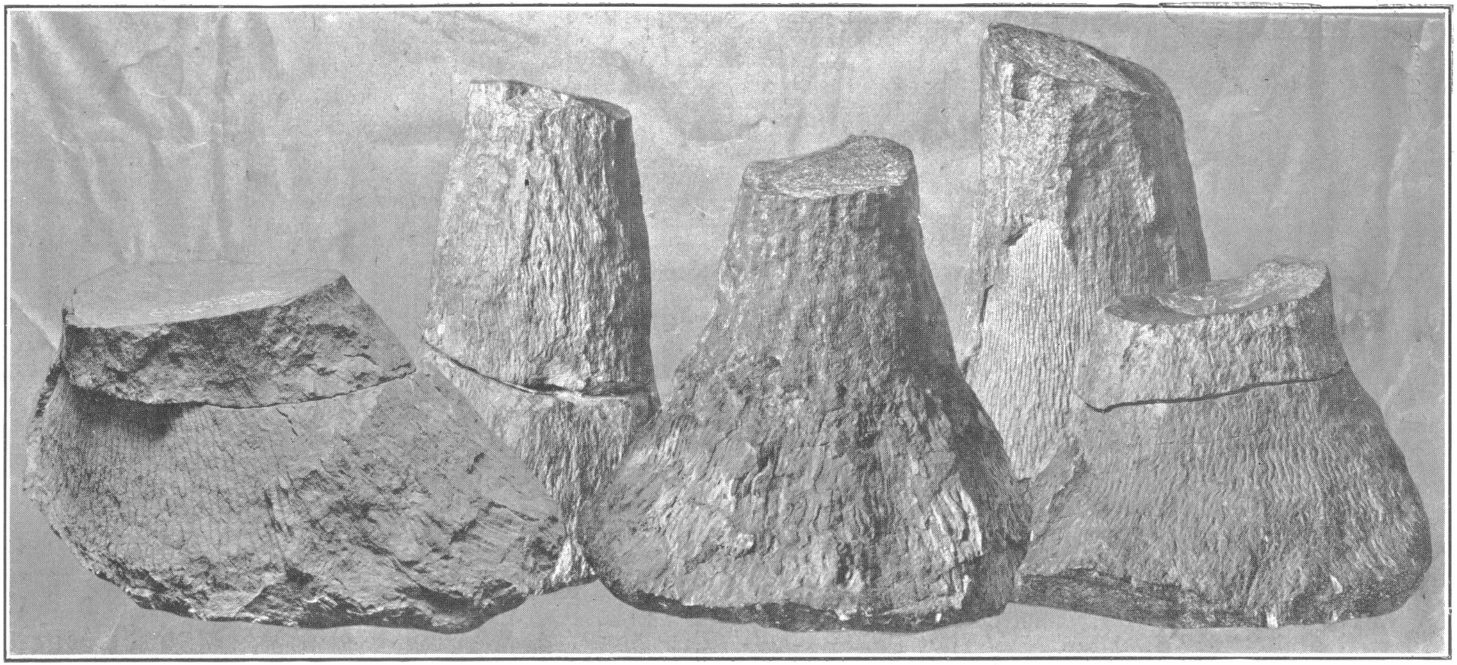
As we move still further back into the history of the earth to years when the trees were of still simpler character and a steeper topography seldom brought them into such easy reach of the recording waters as did the low and swampy sea shores of the Carboniferous period, we have been able to learn of the nature of the Devonian vegetation chiefly from the fern-like stems, Lepidodendron branches and other twigs and stipes which were carried out to sea by the flow of the rivers from the Devonian hills. The trees of the Devonian forests were not sparse and scattered. We may have come to think them so because geologists have usually happened on their remains when looking for other things among the marine deposits. The well known "Naples tree," the Archaeosigillaria, from these Devonian rocks, which rose to a height of 25 feet and is now mounted in the State Museum at Albany, is such a tree trunk carried out to sea by the flow of some forest-lined river. The rivers of the Devonian time which tore their westward way down the wooded slopes of the Old Land where the Southern New England states and their buried Atlantic remnants now lie, emptied themselves of a vast burden of sand which is now piled up to great thicknesses in the Catskill region of New York, the hills and valleys of which now bound what was the seaward edge of that ancient land. Until recently we have never quite realized the richness of these Catskill hills in the relics of the Devonian forests, but an expedition among them this year, brought into the State Museum five thousand pounds of their remains, aside from the story I am about to tell.



THE BASES OF TWO TREES FROM THE UPPER LEVEL, VIEWED FROM THE UNDERSIDE. THE ABSENCE OF ROOTS IS CLEARLY INDICATED, BUT THERE ARE TRACES OF ROOTLETS, AND THE RADIAL RIDGES SEEM TO BE CONTINUOUS WITH THE RIDGES OF THE TRUNK. DIAMETER 25 AND 38 INCHES.



A great autumn freshet in the upper valley of the Schoharie Creek in 1869 tore out bridges, culverts and roadbeds around the little village of Gilboa where now the City of New York is impounding waters for the use of its own future citizens, and exposed in the bed rock of the hills a series of standing stumps of trees. These stumps stood all on the same level in the rocks and their rootlets ran down into the original mud in which they had grown, now turned into a dark or greenish shale. All had been cut off by some ancient flood at the same height above the base, some three or four feet; some were large and others smaller, the largest having a diameter in the shaft of two feet or more with broad expanding root-base like a flattened turnip. Thus were brought to light the standing remains of the most ancient forest growth known in the geological records in any part of the world. Ten of these tree stumps were taken out from their ancient forest, all at the same level in the rocks, and they have long constituted one of the remarkable exhibits of the vanished flora of the Devonian age. The old locality has long been deeply covered and the rocks of that level which carried these trees do not come to the surface again in the vicinity. But an effort of rediscovery made this year has been attended with unexpected results in finding the stumps of other trees of the same sort at a level sixty feet higher in the rock beds, giving evidence that the forest growths here, like the successive coal forests of the Joggins, had reappeared in the same region at a later stage in Devonian history after the first growth had been buried beneath the sea. This Schoharie Forest, earliest of all recorded forests of the earth, is of very great interest from a scientific point of view, though we are puzzled not a little to comprehend just the nature of these shore-growing woods. These trees are most nearly comparable to the tree ferns of existing tropical forests but no botanist would be content with this comparison, as they have a fructification in distinct sporangia or double purses not unlike the "keys" of a maple, quite unlike the spore-cases of the ferns; "seed-ferns" whose leaves were apparently narrow and strap-like, branching simply and rarely and terminating in these twin fruit-cases. If the diameter of the trunks is carried upward in a tapering slope these trees must have reached the very considerable height of 20-30 feet, but it is possible that the trunks broke up not so far above their base into a shrubby or bushy cap. Their real nature is still a problem for the student of fossil plants. They have been called Psaaronius, but this name has not meant very much to botanists except as an expression for a fern-like plant of unsettled affinities. Now however, as the fruit of this Devonian tree is known, that and the character of its rutabaga-like base taken in connection with what have been supposed to be aerial rootlets running up the trunk, may prove the entire combination to show affinities with the cycads. But in any case we are pretty certain



SOME OF THE TREES FROM THE LOWER LEVEL, ALL FOUND AT THE SAME HORIZON. THE HEIGHT OF THE CENTRAL TRUNK IS 2 FEET, WIDTH AT BASE 22 INCHES of having here a composition of structures wholly primitive among upstanding trees and hard to interpret in the light of existing plants. This will be disclosed in time but, whatever the nature of this primitive forest growth may prove to be, we may think of it as being almost the earliest expression of the successful effort in the plants to acquire and keep an upright position. Not long before, as geologic time is reckoned, the plants had been wholly aquatic. They had been living in the ponds of the old land and the estuaries of the coast-line. Their original home, it would seem, had been the soils of the ancient continents whence they had in a primitive day, migrated in some part into the sea itself. But the picture is presented to us now of the upward struggle toward better opportunity of growth and freer development into the all surrounding air. Dr. Berry, of Johns Hopkins, a brilliant paleobotanist, has suggested that the plants of the earth began to burst into flower at about the time the type of man, the primate, disclosed itself in the progress of life. And it may be said, I think, with the same approximation to truth that the plant sought and reached its upright position just as the vertebrate type of life became established on the earth.

At any rate our ancient New York forests afford an index to the geography of the western Catskills and the Schoharie valley during the Late Devonian Period to which they belong. We have said that the tree stumps were found in places where they grew, that the shales under them are the muds in which they were rooted and that they are preserved at at least two levels in the rocks one sixty feet above the other. Not far under the lowest forest the rocks carry true marine fossils. Tangled in the rootlets of the lower trees were found the remains of some brackish water crustaceans. These facts of themselves show that the sea which covered this region slowly withdrew and the trees crept down from the land to the water's edge, or grew over the delta plain of the fresh water streams flowing in from the old land at the east. Then for a long time the first forest must have been flooded by the waters, probably by the rising of the sea which deposited the 60 feet of overlying rocks, until another retreat of the water again brought the forest down to the shore. There was an oscillation of the coast-line, the sea rising and falling and the trees approaching, receding and approaching again toward the edge of the water. Thus the full story of this primitive forest is rich in the promise of an instructive chapter in the progress of that great division of the kingdom of life, which, though rooted and fettered from almost the beginning of its history, has kept pace in its own way with the progress of that subkingdom to which we belong.